WSDOT MITIGATION SITES
SOUTHWEST REGION

2003 MONITORING REPORT

Wetland Assessment and Monitoring Program

Monitoring Staff
Jesse Barham
Jodie Beall
Fred Bergdolt
Tony Bush
Paul Dreisbach
Cyndie Prehmus
Tuesday Shean
Bob Thomas

Issued March 2004

Washington State Department of Transportation

Environmental Services Office

Southwest Region 2003 Annual Monitoring Report

For additional information about this report or the WSDOT Wetland Assessment and Monitoring Program, please contact:

Washington State Department of Transportation
Environmental Services Office
P. O. Box 47332
6639 Capital Boulevard South
Tumwater, WA 98504-7732

Fred Bergdolt, Wetland Monitoring Field Coordinator
Phone: 360-570-6645
E-mail: bergdof@wsdot.wa.gov

Table of Contents

Appendices

Executive Summary

The following tables summarize success standards and results obtained in 2003.

Clark County

Site Name	Success Standards	2003 Results
SR 5 Burnt Bridge Creek (Year 1/5)		
	≥ 40% aerial cover of FAC and wetter herbaceous species in the emergent zone	59% ($CI_{80\%}$ = 49-69% cover)
	≥ 80% survival in the scrub-shrub zone	86% (total count)
	≥ 80% survival in the riparian zone	86% (total count)
	≥ 80% survival in the forested buffer	88% (total count)
	Control of reed canarygrass	Weed control program implemented

Cowlitz County

Site Name	Success Standards	2003 Results
SR 504 Kid Valley (Year 4/5)		
	≥ 50% aerial cover of herbaceous species in the emergent wetland, with three FAC and wetter species	61% ($CI_{90\%}$ = 58-64% cover) 24 FAC and wetter species
	≥ 15% aerial cover of woody vegetation in the scrub-shrub wetland	7% aerial cover
	Measurable growth of trees and shrubs	Growth of planted *Spiraea douglasii* (rose spirea) observed
	Ponding or saturated soils for 12% of the growing season	Observed
	Five logs and/or root wads present on site	Present
	Observe raptors, passerines and waterfowl using the site for roosting, nesting or foraging habitat	Observed

Lewis County

Site Name	Success Standards	2003 Results
SR 12 Peters Road (Year 5/10)		
	40% woody cover in floodplain forest	< 5% aerial cover
	< 10% invasive species	17% ($CI_{80\%}$ = 15–20% cover)
	≤ 40% woody cover in bank stabilization area	2-3% aerial cover

List of Acronyms

Acronym	Meaning
CI	Confidence Interval (see Methods and Glossary)
ECY	Washington State Department of Ecology
FAC	Facultative Indicator Status (Reed 1988)
FACW	Facultative Wetland Indicator Status (Reed 1988)
IP	Individual Permit
MP	Mile Post
NWP	Nationwide Permit
OBL	Obligate Wetland Indicator Status (Reed 1988)
SR	State Route
USACE	United States Army Corps of Engineers
WDFW	Washington Department of Fish and Wildlife
WSDOF	Washington Department of Fisheries
WSDOT	Washington State Department of Transportation

Introduction

History
Infrastructure improvements including highway construction projects, highway interchanges, and bridges have accompanied economic and population growth in the state of Washington. The Washington State Department of Transportation (WSDOT) routinely evaluates the potential for degradation of critical areas that result from these infrastructure improvements. WSDOT strictly complies with applicable federal, state, and local environmental regulations, including the Clean Water Act and the state "no net loss" policy for wetlands (Executive Order 89-10). Generally, mitigation sites are planned when transportation improvement projects adversely affect critical areas. The WSDOT Wetland Assessment and Monitoring Program monitors these mitigation sites as a means of evaluating compliance with permit conditions and tracking overall development. Sixty-three sites statewide were monitored in 2003. Of the 26 sites included in this year's Annual Monitoring reports, 21 have standards to be addressed in 2003, and five are provided as a requested courtesy.

Purpose
The purpose of this document is to report the status of Southwest Region WSDOT mitigation sites with respect to success standards for 2003 (Map 1).[1] We rely on feedback from the users of this report to ensure its contents are clear, concise, and meaningful.

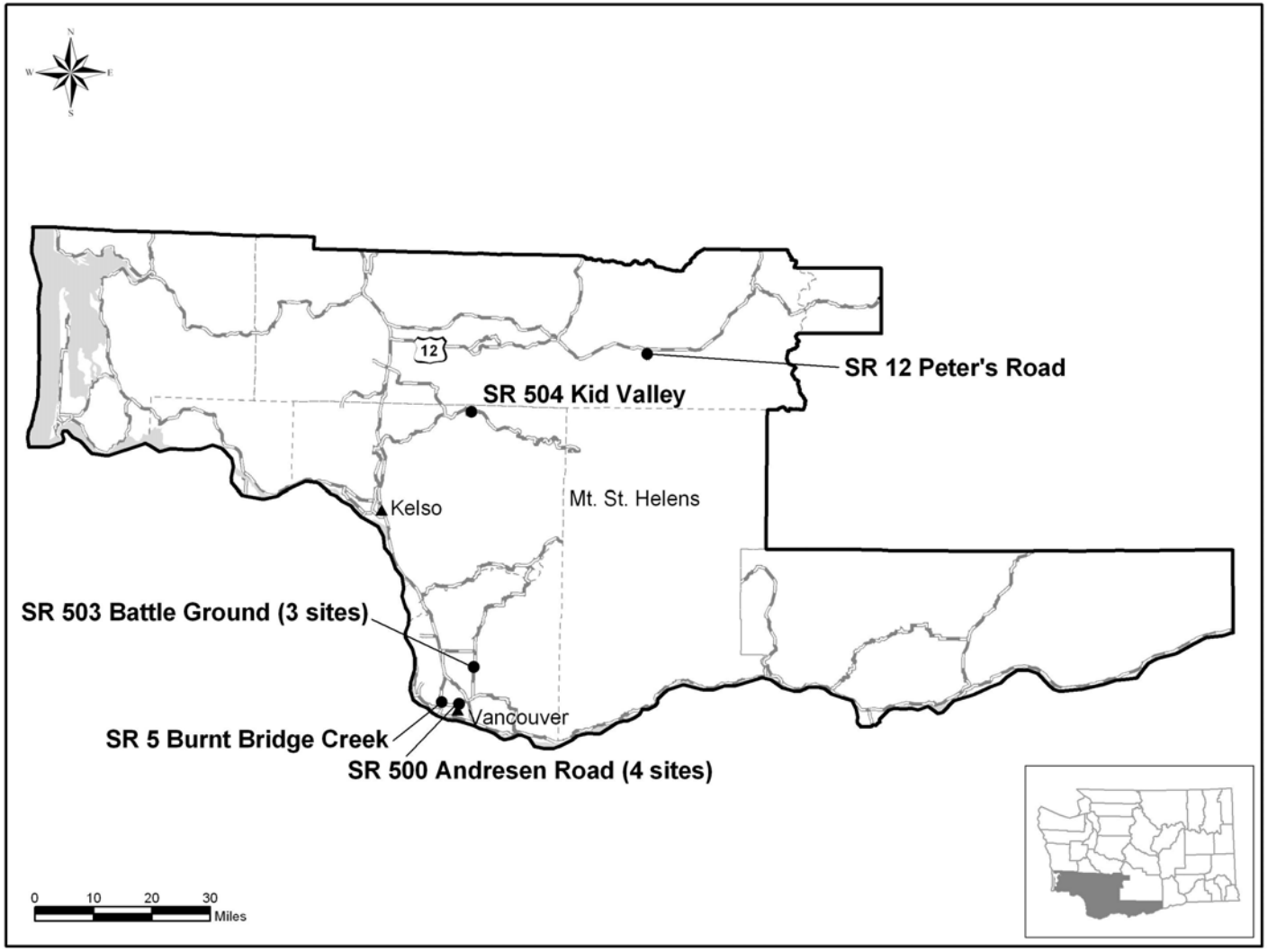
Process
Monitoring typically begins the first spring after a site is planted and continues for the time period designated by the permit or mitigation plan. The monitoring period generally ranges from three to ten years. In special cases sites may be monitored beyond the designated period.

Monitoring activities are driven by site-specific success standards detailed in the mitigation plan or permits. Data are collected on a variety of environmental parameters including vegetation, hydrology, and wildlife. When data analysis is complete, information on site development is communicated to region staff to facilitate management activities as part of an adaptive management process. Monitoring reports are issued to regulatory agencies and published on the web at:

www.wsdot.wa.gov/environment/wetmon/default.htm

[1] Sites shown on the map without reports were evaluated for internal feedback only. A report is issued only for sites with success standards that apply to the current year.

Map 1: Southwest Region Sites Monitored in 2003



Methods

Methods used for monitoring mitigation sites change as site requirements and customer needs evolve. Quantitative data collection techniques presently in use are based on standard ecological and biostatistical methods.[2] The wetland program's current monitoring methods include the following key elements:

Objective-based Monitoring

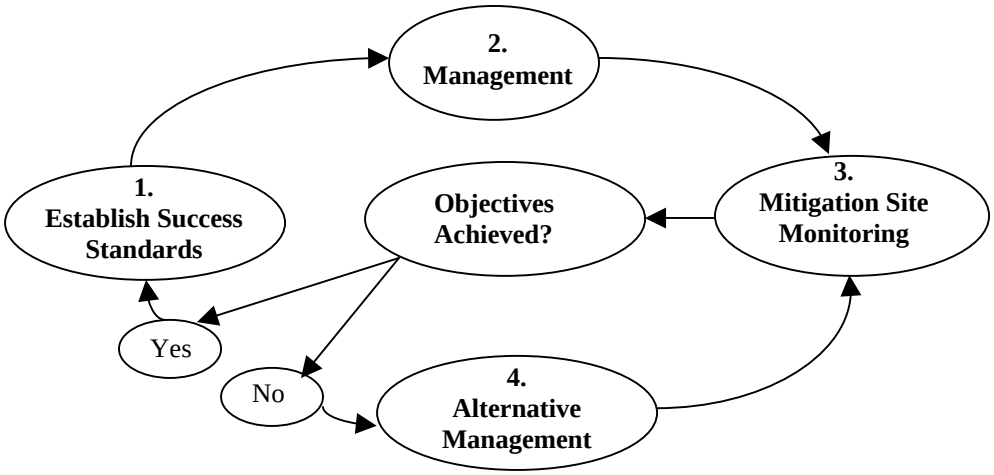
We collect data using a monitoring plan and sampling design developed specifically for each site. The monitoring plan and sampling design address success standards, permit requirements, contingencies, and other considerations as appropriate.

Adaptive Management

The adaptive management process includes four iterative steps:

1. success standards are developed to describe the desired condition,
2. management action is carried out to meet the success standard,
3. the response of the resource is monitored to determine if the success standard has been met, and
4. management is adapted if the standards are not achieved.

Monitoring is integral to the success of an effective adaptive management strategy. Without valid monitoring data, management actions may or may not result in improved conditions or compliance with regulatory permits. Timely decisions, based on valid monitoring data, result in increased efficiency and higher probabilities of success (Shabman 1995; Thom and Wellman 1996). The adaptive management process is illustrated in Figure 1.1.



(Redrawn from Elzinga et al. 1998)

Figure 1.1 The Adaptive Management Process

[2] These methods are based on techniques described in Bonham (1989), Elzinga et al. (1998), Krebs (1999), Zar (1999), and other sources.

Statistical Rigor

WSDOT's monitoring approach strives to minimize subjectivity in data collection and increase the reliability of data collection and analysis. Important considerations include appropriate sampling design, sampling resolution, random sampling procedures, and sample size analysis. Our goal is to provide customers with an objective evaluation of site conditions based on valid and reliable monitoring data.

Success Standards and Sampling Objectives

Site objectives and success standards are important elements of a mitigation plan. They indicate the desired state or condition of the mitigation site at a given point in time. Conditional permit requirements, if different from success standards in the mitigation plan, are also evaluated during monitoring activities. Some mitigation plans also provide contingencies if a specific undesirable condition occurs. Contingencies typically initiate a management response at the onset of a particular condition, for example, excessive cover by invasive species or insufficient cover by trees and shrubs.

Wetland Assessment and Monitoring Program staff thoroughly examine goals, objectives, success standards, and site permits to understand the desired site condition or characteristics to be measured. Six elements are sought in relation to each success standard to ensure measurability of the desired condition: species indicator, location, attribute, action, quantity/status, and time frame. Where one or more of the six elements is undocumented or unclear in the mitigation plan or permit, clarification is sought from region staff.

Success Standards are copied verbatim from the mitigation plan in the Success Standards and Sampling Objectives section of each site report. Differences in common usage of the terms *aerial* and *areal* have made their interpretation in mitigation plans difficult. We feel that the term *aerial* better describes the intent of the mitigation plans in most cases. Where we judge the word *areal* has been used arbitrarily in the Success Standards, we follow it with a (*sic*) notation. The Glossary defines the meaning of these words as used in this document.

Information presented in the first table of each site report is obtained directly from the mitigation plan and permits, as appropriate.

Sampling may be required to address success standards unless an efficient and reliable total accounting of the target attribute can be conducted. Sampling objectives are developed to guide the data collection process. Sampling objectives typically include a confidence level and confidence interval half width.

The results of sampling are included in the individual site reports with the confidence level and confidence interval noted as ($CI_X = Y_1$-Y_2), where CI = confidence interval, X = confidence level, and confidence interval width is expressed as Y_1 low estimate to Y_2 high estimate. For example, an estimated aerial cover provided by woody species reported as 65% ($CI_{80\%}$ = 52-78% aerial cover) means that we are 80% confident that the true aerial cover value is between 52% and 78% (Figure 1.2).

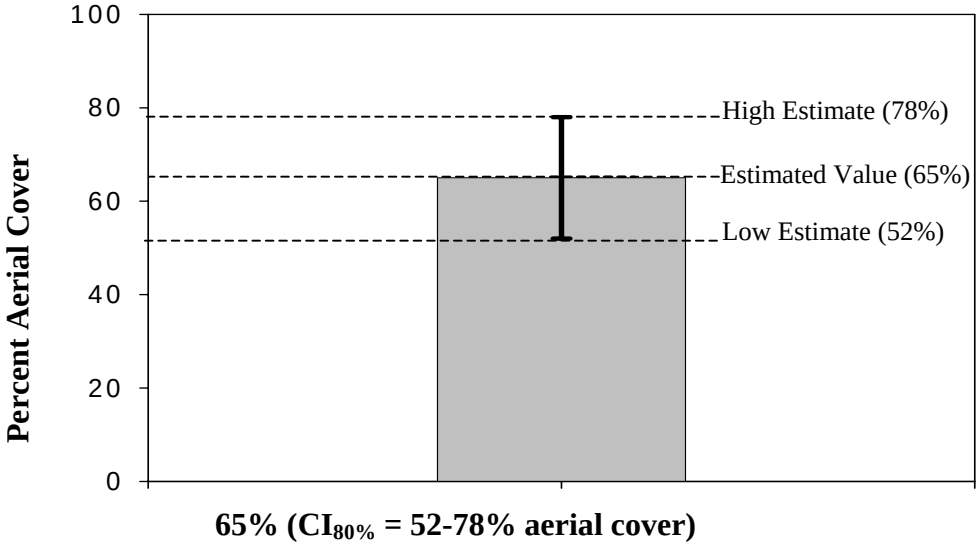


Figure 1.2 Estimated Cover Value Expressed with Confidence Interval Range

For compliance purposes, aerial cover calculations include only areas covered by rooted vascular plants (including floating-leaved species). Areas covered by thallophytes (algae, fungi, bacteria), bryophytes (mosses and liverworts), structures, or aquatic vegetation are not included in aerial cover calculations. Scientific names, most common names, and nativity used in this report were obtained from the *PLANTS Database* (USDA 2003). Hydrophytic plant indicator status was obtained from the *National List of Plant Species that Occur in Wetlands: Northwest* (Reed 1988 and 1993). Where invasive or noxious weeds are addressed, county specific listings in the *State Noxious Weed List* are referenced (Washington State Noxious Weed Control Board 2003).[3]

Sampling Design

When sampling is required, a sampling design is developed for the site or zone of interest. Sampling designs can vary from simple to complex depending on the number and type of attributes to be measured. Specific elements such as the size and shape of the site, the presence of environmental gradients, plant distribution patterns, and the amount of time and resources available for monitoring are factors that influence the sampling design. Elements of the sampling design may include the location of the baseline, orientation of transects (Figure 1.3), the method of data collection, and the number and type of sample units to be used. Depending on the sampling objective and site characteristics, transects may vary in number, length, and separation distance. Sampling transect locations are determined by using either a simple, systematic, stratified, or restricted random sampling method.

[3] In some cases, other nuisance species may be included in invasive cover estimates.

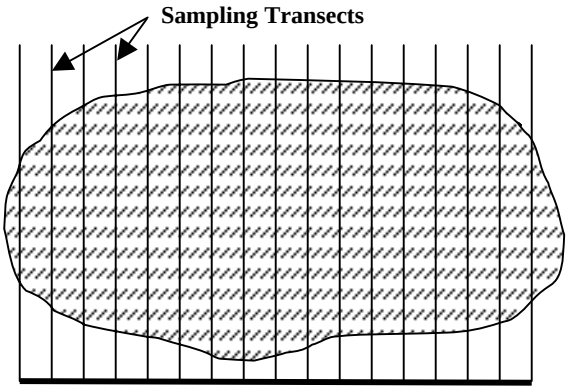


Figure 1.3 Baseline and Sampling Transects

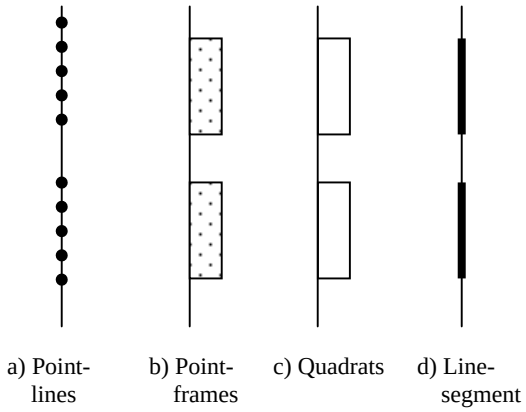


Figure 1.4 (a-d) Sampling Transects and Sample Units

A diagram showing the sampling design is typically included in mitigation site reports. Sample units appropriate to one or more of the methods described below are randomly located on or adjacent to the sampling transects (Figure 1.4 a-d). These drawings are general representations of the actual sampling designs and do not include specific details.

Point-Line Method

The point-line technique (Bonham 1989; Elzinga et al. 1998) can be used where vegetative cover is an attribute of interest. This method involves randomly locating sample units consisting of fixed sets of points along sampling transects (Figure 1.4a). Tools used to collect point-line data include point-intercept devices, pin flags, or densitometers. These tools are used to identify point locations. Target vegetation intercepted by the point locator is recorded. If target species are not encountered on the point; bare soil, non-vascular plant, or habitat structure is recorded as appropriate. For each sample unit, cover is determined based on the number of times target vegetation is encountered divided by the total number of points. For example, if invasive species were encountered on 20 points from a sample unit composed of 100 points, the aerial cover of invasive species for that sample unit is 20 percent.

Point-Frame Method

Point-frames are another tool that may be used to measure vegetative cover (Bonham 1989; Elzinga et al. 1998). A point-frame is a rectangular frame that encloses a set of points collectively serving as a sample unit (Figure 1.4b).[4] The sample unit is lowered over herbaceous vegetation and data is recorded where target vegetation intercepts point locations. As with the point-line method, a cover value for each sample unit is determined. For example, if FACW and OBL species were encountered on 20 points in a

[4] The WSDOT Wetland Assessment and Monitoring Program typically uses a frame formed with polyvinyl chloride (PVC). Strings span the frame lengthwise and points are marked on the strings using a standard randomization method.

point-frame composed of 40 points, the aerial cover of FACW and OBL species for that point-frame sample unit is 50 percent.

Quadrat Method

To measure survival or density of planted trees and shrubs in an area, quadrat sample units are randomly located along sampling transects (Bonham 1989; Elzinga et al. 1998). Quadrat width and length are based on characteristics of the vegetative community and patterns of plant distribution. Quadrats are typically located lengthwise along sampling transects (Figure 1.4c). Plants within a quadrat are recorded as alive, stressed or dead. The success standard or contingency threshold can be addressed with a percent survival estimate of plantings, or a density per square meter of living plantings as appropriate. For example, if eight planted woody species were recorded as alive and two were recorded as dead in a sample unit measuring 1 x 20 meters, the survival of planted woody species for that sample unit would be 80%, and the density would be 0.4 live plants per square meter.

Line-Intercept Method

Cover data for the woody species community is collected using the line-intercept method (Bonham 1989; Elzinga et al.1998).[5] Line-segments, serving as sample units, are randomly located along sampling transects (Figure 1.4d). All woody vegetation intercepting the length of each sample unit is identified and the length of each canopy intercept recorded. For each sample unit, the sum of the canopy intercept lengths is divided by the total length to calculate an aerial cover value. For example, if woody vegetation was encountered on 80 meters from a 100-meter sample unit, the aerial cover for that sample unit is 80 percent.

Sample Size Analysis

With each of the above methods, sample size analysis is performed in the field to ensure that an adequate number of sample units are obtained to report the data at the specified confidence level and interval. The mean percent aerial cover value and standard deviation are calculated from the data, and sample size analysis is conducted. For data reported in this document, the following sample size equation for estimating a single population mean or a population total within a specified level of precision was used to perform this analysis (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[6]
n = unadjusted sample size

[5] Depending on site conditions and other considerations, woody cover data may be collected using the point-line method and a densitometer.

[6] In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

A sample size correction to *n* is necessary for adjusting "point-in-time" parameter estimates.[7] It is the adjusted *n* value that reveals the number of sample units required to report the estimated mean value at a specified level of confidence.

Wildlife Monitoring

Many mitigation plans include goals and objectives that address wildlife. For these sites, wildlife monitoring is conducted to provide information to support the results of the vegetation monitoring. An example of an objective that triggers such wildlife monitoring is presented below:

> Objective – Wildlife
> Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of fruit-bearing shrubs and stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. Overall, creating an emergent and scrub-shrub wetland is intended to provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians.

Some success standards contain more specific reference to monitoring wildlife. In these cases, a variety of wildlife monitoring techniques (see sections below) are used to evaluate success. An example of such a success standard follows:

> Success Standard:
> Development of habitat diversity and structure will be determined by the diversity and numbers of wetland dependent species identified during the monitoring period. The sites will meet this objective if wildlife species that utilize wetlands for some or all of their habitat requirements are located.

Incidental wildlife observations are recorded during all site visits.

Bird Monitoring

Sites with goals, objectives or success standards addressing the avian community receive three to four bird surveys conducted during the breeding season (April through mid-July). The point count method (Ralph et al. 1993) is used to document species richness and relative abundance.

Species diversity indices (H) may be calculated from bird survey data using the Shannon-Wiener function (Krebs 1999). Results are expressed as a mean annual species diversity index.

$$H' = -\sum_{i=1}^{s} (p_i)(\log p_i)$$

H' = index of species diversity
s = number of species
p_i = proportion of sample belonging to *i*th species

[7] Adjusted *n* values found in this report were obtained using the algorithm for a one-sample tolerance probability of 0.90 (Kupper and Hafner 1989; Elzinga et al 1998).

The following *t* test is used to test the null hypothesis that diversity indices from different years are equal (Zar 1999).

$$t = \frac{H'_1 - H'_2}{S_{H'_1 - H'_2}}$$

H' = index of species diversity
$S_{H'_1 - H'_2}$ = standard error of the difference between species diversity indices H'_1 and H'_2

Amphibian Monitoring

Sites with goals, objectives, or standards referencing amphibians may be monitored using methods adapted from Olson et al. (1997). Methods may include funnel trapping on sites with a water depth of one decimeter or greater. Call surveys and area searches may be used to assess terrestrial components of sites without standing water. Incidental amphibian observations are recorded during other monitoring activities. Potential for amphibian habitat may be qualitatively assessed.

Hydrology Monitoring

Primary and secondary field indicators of wetland hydrology (ECY 1997) are recorded to address hydrology standards and to aid in future delineation efforts. Wetland mitigation sites are delineated in the spring following the last year of vegetation monitoring so the actual wetland area can be compared to the planned wetland area.

Clark County Site

SR 5 Burnt Bridge Creek

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 5 Burnt Bridge Creek mitigation site in August 2003. Monitoring data were obtained to compare to first-year success standards. Activities include surveys of the herbaceous and planted woody species communities. Table 2.1 provides general site information and Table 2.2 summarizes this year's monitoring results.

Table 2.1 General Information for the SR 5 Burnt Bridge Creek Mitigation Site

Project Name	I-5, Salmon Creek to I-205		
City of Vancouver Shoreline Master Program	Complies with Conservation/Restoration Element		
Township/Range/Section	T.2N, R.1E, S.15, NE/4		
Mitigation Location	East of SR 5, west of Burnt Bridge Creek, Clark County		
Monitoring Period	2003 to 2007		
Year of Monitoring	1 of 5		
Area of Project Impact	0.97 acres		
Type of Mitigation	Wetland Creation	Wetland Restoration	Buffer Creation
Area of Mitigation	1.38 acres	0.58 acres	1.76 acres

Table 2.2 Monitoring Summary for the SR 5 Burnt Bridge Creek Mitigation Site

Success Standards	2003 Results[8]	Management Activities
1. $\geq$ 40% aerial cover of FAC and wetter herbaceous species in the emergent zone	59% ($CI_{80\%}$ = 49-69% cover)	
2. $\geq$ 80% survival in the scrub-shrub zone	86% (total count)	Replanted/irrigation
3. $\geq$ 80% survival in the riparian zone	86% (total count)	Replanted/irrigation
4. $\geq$ 80% survival in the forested buffer	88% (total count)	Replanted/irrigation
5. Control of reed canarygrass	Weed control program implemented	Weed control

Success Standards and Sampling Objectives

The success standards for the SR 5 Burnt Bridge Creek mitigation site were excerpted from the *Mitigation Plan for I-5, Salmon Creek to I-205* (Corlett 2002). A companion sampling objective follows the success standard where appropriate. Appendix A provides the complete text of the success standards for this project.

[8] Estimated values are presented with their corresponding statistical confidence interval. For example, 59% ($CI_{80\%}$ = 49-69% cover) means we are 80% confident that the true aerial cover value is between 49% and 69 percent.

Success Standard 1
At year 1, there will be a minimum of 40% cover within the emergent zone (2003).

> Sampling Objective 1
> To be 80% confident the true aerial cover by native FAC and wetter herbaceous species in the wetland is within 20% of the estimated value.

Success Standard 2
At year 1, there will be a minimum of 80% survival of planted species within the scrub-shrub zone (2003).

> Sampling Objective 2
> To be 80% confident the true survival of planted species within the scrub-shrub zone is within 20% of the estimated value.

Success Standard 3
At year 1, there will be a minimum of 80% survival of planted tree and shrub species within the riparian zone (2003).

> Sampling Objective 3
> To be 80% confident the true survival of planted tree and shrub species within the riparian zone is within 20% of the estimated value.

Success Standard 4
At year 1, there will be a minimum of 80% survival of planted tree and shrub species within the forested buffer (2003).

> Sampling Objective 4
> To be 80% confident the true survival of planted tree and shrub species within the forested buffer is within 20% of the estimated value.

Success Standard 5
At year 1, reed canarygrass will be controlled in all planting zones of the wetland mitigation site (2003).

> Sampling Objective 5
> To be 80% confident the true aerial cover by reed canarygrass within each of the zones on the wetland is within 20% of the estimated value.

Methods

To evaluate aerial cover of herbaceous species in the emergent zone, 20 temporary transects were placed perpendicular to Baseline 1 using a systematic random sampling method (Figure 2.1). Thirty-five point-frame sample units (30 points each) were randomly positioned along sampling transects in the emergent areas (Success Standards 1 and 5). Areas of planned open water and preserved wetland were not sampled.

A total census was conducted to evaluate survival of planted trees and shrubs (Success Standards 2, 3, and 4). Plantings in the riparian, upland, and shrub-scrub wetland zones were identified and recorded as alive, or dead. Empty planting wells were recorded as dead unknowns. The results of the total count were used to determine a survival percentage.

The point-line method was used to evaluate invasive species cover in the riparian zones on both sides of Burnt Bridge Creek. Sample units were randomly placed along the transects. On the west side of the creek, data were collected along 23 point-line sample units 10 meters in length (40 points each). From Baseline 2 on the east side of the creek, data were collected along 19 point-line sample units 25 meters in length (50 points each).

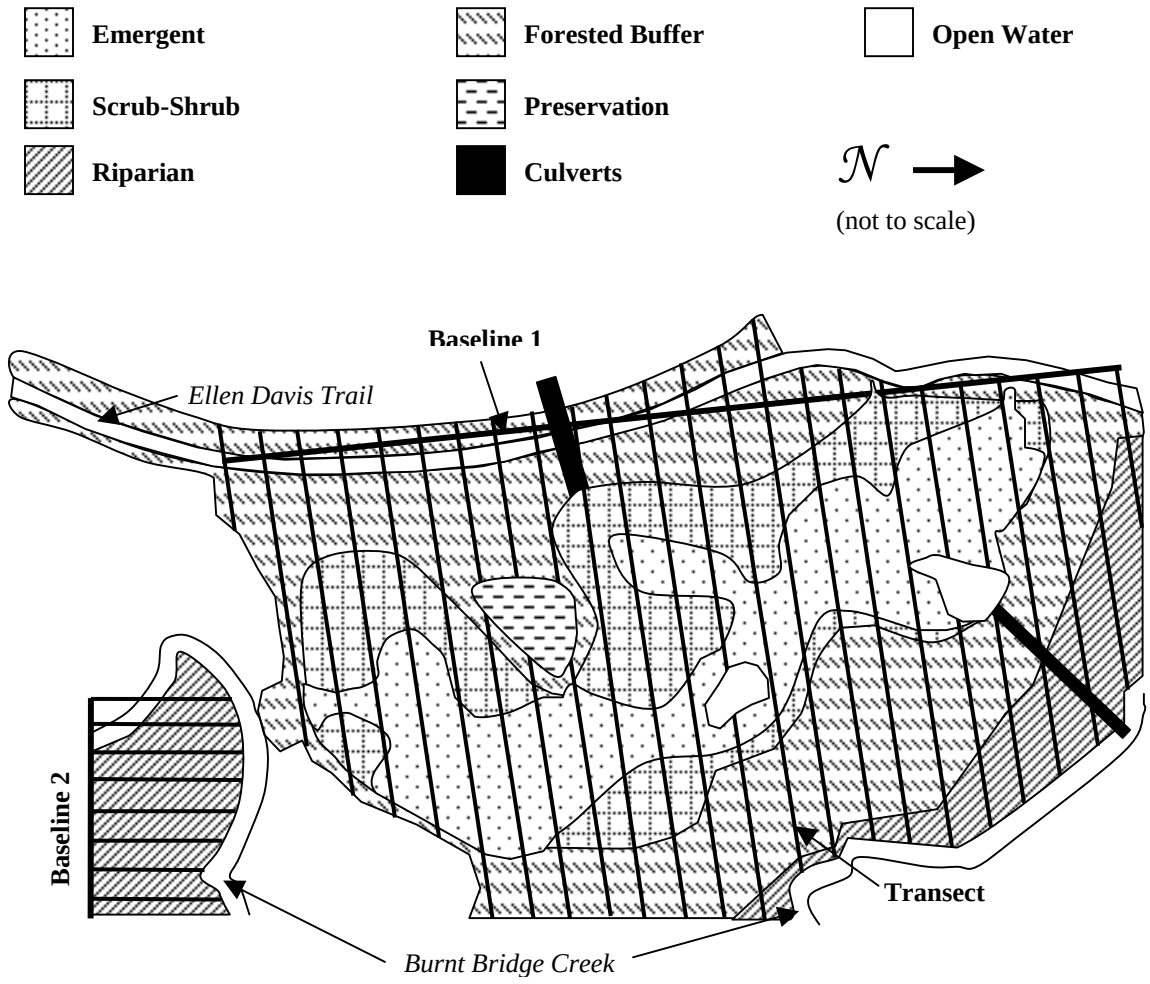


Figure 2.1 SR 5 Burnt Bridge Creek Mitigation Site Sampling Design (2003)

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[9]
n = unadjusted sample size

For additional details on the methods described above, see the Methods section of this report.

Results and Discussion

Success Standard 1 – Minimum of 40% Aerial Cover in the Emergent Zone

Aerial cover provided by FAC and wetter native herbaceous species in the emergent area is estimated to be 59% ($CI_{80\%}$ = 49-69% cover). The first-year aerial cover requirement has been met. Two of the five planted emergent species *Sidalcea oregana* (Oregon checker mallow), and *Alopecurus pratensis* (meadow foxtail) were not observed in the planned emergent areas. However, eleven other native FAC and wetter herbaceous volunteer species have colonized parts of the emergent zone (Table 2.3).

Table 2.3 Native Herbaceous Species at the SR 5 Burnt Bridge Creek Mitigation Site in 2003

Scientific Name	Common Name	Status	Planted
Alisma triviale	American water plantain	OBL	
Bidens cernua	nodding beggartick	FACW+	
Eleocharis ovata	ovate spikerush	OBL	
Epilobium ciliatum	fringed willowherb	FACW-	
Glyceria leptostachya	davy mannagrass	OBL	
Gratiola ebracteata	bractless hedgehyssop	OBL	
Juncus effusus	soft rush	FACW	
Ludwigia palustris	water purslane	OBL	
Rorippa islandica	bog yellowcress	OBL	
Sagittaria latifolia	broadleaf arrowhead	OBL	X
Schoenoplectus tabernaemontanii	soft-stem bulrush	OBL	X
Schoenoplectus maritimus	seacoast bulrush	OBL	
Sparganium angustifolium	narrowleaf bur-reed	OBL	X
Typha latifolia	broadleaf cattail	OBL	

Success Standard 2, 3 and 4 – At Least 80% Survival in the Scrub-Shrub, Riparian and Forested Buffer Zones

Based on a total count of planted woody species, survival was 86% in both the scrub-shrub and riparian zones (Figure 2.2), 88% in the forested buffer, and 87% across the entire site. This meets the 80% survival requirement. Table 2.4 shows the survival counts by zone.

[9] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Table 2.4 Survival at the SR 5 Burnt Bridge Creek Mitigation Site in 2003

Zone	Alive	Dead	Total	Survival
Scrub-shrub	2731	407	3180	86%
Riparian	488	78	566	86%
Forested buffer	2563	356	2919	88%
Site total	5782	841	6623	87%

Success Standard 5 – Control of Reed Canarygrass

Despite weed control efforts, aerial cover of *Phalaris arundinacea* (reed canarygrass) (Class C) was estimated to be 22% ($CI_{80\%}$ = 13-30% cover) in the emergent zone, 22% ($CI_{80\%}$ = 17-26% cover) in the west riparian zone, and 27% ($CI_{80\%}$ = 23-31% cover) in the east riparian zone (across the stream). *Phalaris arundinacea* was concentrated along the banks of Burnt Bridge Creek.

Figure 2.2 SR 5 Burnt Bridge Creek Mitigation Site (August 2003)

Management Activities

In 2003, weed control was conducted, 1325 woody plantings were replaced, and the drip irrigation system was repaired. Weed control focused on *Hedera helix* (English ivy), *P. arundinacea*, and *Rubus* species (blackberries).

Cowlitz County Site

SR 504 Kid Valley

The following report summarizes monitoring activities completed by the Washington State Department of Transportation (WSDOT) Wetland Assessment and Monitoring Program at the SR 504 Kid Valley mitigation site in September 2003. Data were obtained to compare to third-year success standards. Activities include hydrology, vegetation and wildlife surveys. Table 3.1 provides general site information and Table 3.2 shows this year's monitoring results.

Table 3.1 General Information for the SR 504 Kid Valley Mitigation Site

Project Name	SR 504 Kid Valley Road to Maple Flats
USACE NWP Number	98-4-00050
Mitigation Location	Kid Valley Road off Toutle River, Cowlitz County
Monitoring Period	1999 to 2005
Year of Monitoring	5 of 7[10]
Area of Project Impact	0.48 acres
Type of Mitigation	Wetland Creation
Area of Mitigation	1.90 acres

Table 3.2 Monitoring Summary for the SR 504 Kid Valley Mitigation Site

Success Standards	2003 Results[11]
1. ≥ 50% aerial cover of herbaceous species in the emergent wetland, with three FAC and wetter species	61% ($CI_{90\%}$ = 58-64% cover) 24 FAC and wetter species
2. ≥ 15% aerial cover of woody vegetation in the scrub-shrub wetland	7% aerial cover
3. Measurable growth of trees and shrubs	Growth of planted *Spiraea douglasii* (rose spirea) observed
4. Ponding or saturated soils for 12 percent of the growing season	Observed
5. Five logs and/or root wads present on site	Present
6. Observe raptors, passerines and waterfowl using the site for roosting, nesting or foraging habitat	Observed

[10] Trees and shrubs failed to establish in the scrub-shrub wetland during the first two years of site development. In 2001, a fence was installed along the perimeter of the mitigation site to exclude elk. The scrub-shrub wetland was subsequently replanted and the monitoring period was extended. Year-3 success standards were addressed in 2003. The monitoring period has been extended to 2005.

[11] Estimated values are presented with their corresponding statistical confidence interval. For example, 61% ($CI_{90\%}$ = 58-64% cover) means we are 90% confident that the true aerial cover value is between 58% and 64 percent.

Success Standards and Sampling Objectives

Third-year success standards for the SR 504 Kid Valley mitigation site were excerpted from the *SR 504 Kid Valley Road to Maple Flats Vicinity Detailed Wetland Mitigation Plan* (Scott 1998). Sampling objectives follow the success standard where appropriate. Appendix B provides the complete text of the success standards for this project.

Success Standard 1
The emergent wetland areas will have ≥ 50% areal *(sic)* cover, which is composed of a minimum of three FAC, FACW or OBL species (2003).

Sampling Objective 1
To be 80% confident the true aerial cover of herbaceous species in the emergent wetland is within 20% of the estimated cover value.

Success Standard 2
There is ≥ 15% areal *(sic)* cover of woody vegetation within the areas designated as scrub-shrub wetland (2003).

Sampling Objective 2
To be 80% confident the true aerial cover of woody vegetation in the scrub-shrub wetland is within 20% of the estimated cover value.

Success Standard 3
The planted trees and shrubs will show measurable growth between annual samplings times based on plant height or width, as shown in photo documentation (2003).

Success Standard 4
There is evidence of ponding or saturated soils in the newly constructed part of the wetland for 12 percent of the growing season (2003).

Success Standard 5
A minimum of five logs and/or root wads will be found on the site during Year One and will remain on the site throughout the monitoring period (2003).

Success Standard 6
Raptors, passerines and waterfowl will be observed using the site for roosting, nesting or foraging habitat within the five-year monitoring period (2003).

Contingency 1
Noxious weeds will be eliminated immediately if found occurring on the site, before large populations can establish (2003).

Contingency 2
A weed control program will be implemented if more than 20% of the vegetated areas are covered with reed canary grass before that threshold is met (2003).

Methods

To evaluate the herbaceous vegetative community, a baseline was located in each wetland area. Forty-four temporary sampling transects were placed perpendicular to the baselines using a systematic random sampling method (Figure 3.1). One hundred and twenty-three 10-meter (40 points each) point-line sample units were randomly placed along these transects.

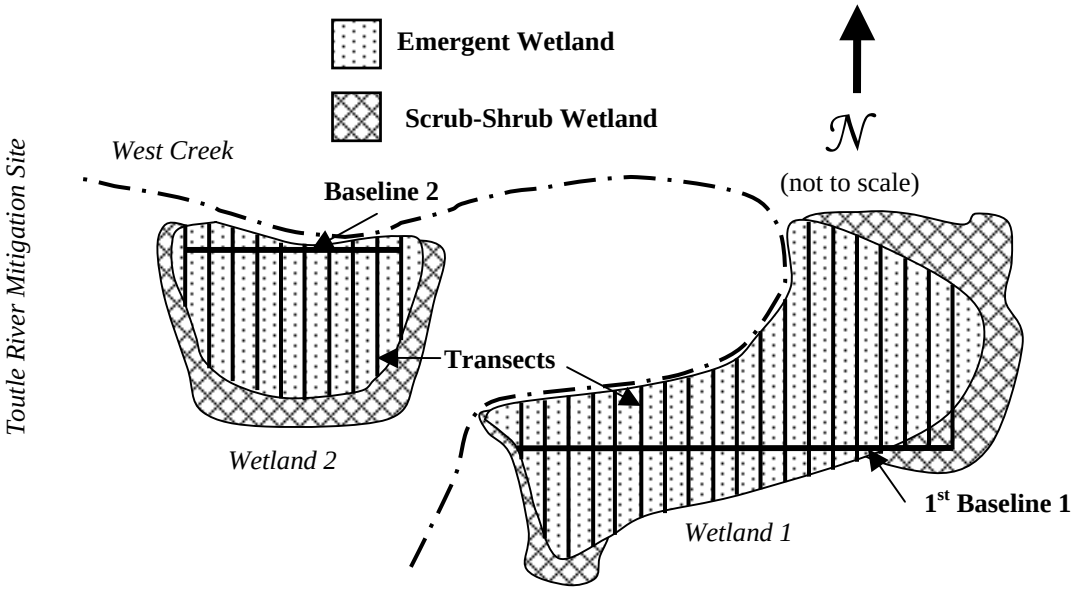


Figure 3.1 SR 504 Kid Valley Mitigation Site Sampling Design Sketch (2003)

Sample size analysis was conducted using the following equation (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[12]
n = unadjusted sample size

Aerial cover of woody (Success Standard 2) and invasive species (Contingency) was assessed qualitatively. Quantitative sampling was not considered appropriate due to the low cover of these species.

Photographs were taken of the tree and shrub community to address Success Standard 3.

To address Success Standard 4, primary and secondary field indicators of wetland hydrology (ECY 1997) were recorded during site visits in April and May 2003.

For additional details on the methods described above, see the Methods section of this report.

[12] In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Results and Discussion

Success Standard 1 – At Least 50% Herbaceous Cover in the Emergent Zones, with a Minimum of Three FAC and Wetter Species

The aerial cover of herbaceous plants in the emergent wetland zones was estimated to be 61% ($CI_{90\%}$ = 58-64% cover). Twenty-four FAC and wetter herbaceous species were observed in the emergent wetland. This meets the third-year species and cover requirements. However, in the same areas, the aerial cover of FAC and wetter herbaceous species was estimated to be 46% ($CI_{90\%}$ = 42-50% cover). Table 3.3 shows the aerial cover of herbaceous species by wetland area and Table 3.4 shows the hydrophytic (FAC and wetter) plant community that is now present.

Table 3.3 Aerial Cover of Herbaceous Species in the Wetland Areas in 2003

Wetland Area	Herbaceous Cover
Wetland 1	53% ($CI_{90\%}$ = 49-57% cover)
Wetland 2	74% ($CI_{90\%}$ = 71-77% cover)
Wetland 1 and 2 combined	61% ($CI_{90\%}$ = 58-64% cover)

Table 3.4 Facultative and Wetter Species in the Emergent Wetland Zones in 2003

Scientific Name	Common Name	Facultative Status
Agrostis capillaris	colonial bentgrass	FAC
Agrostis gigantea	redtop	FAC
Alopecurus geniculatus	water foxtail	OBL
Beckmannia syzigachne	American sloughgrass	OBL
Bidens frondosa	devil's beggartick	FACW+
Carex obnupta	slough sedge	OBL
Echinochloa crus-galli	barnyardgrass	FACW
Eleocharis ovata	ovate spikerush	OBL
Eleocharis palustris	common spikerush	OBL
Festuca rubra	red fescue	FAC+
Gnaphalium palustre	western marsh cudweed	FAC+
Holcus lanatus	common velvetgrass	FAC
Juncus acuminatus	tapertip rush	OBL
Juncus effusus	soft rush	FACW
Lotus corniculatus	birdsfoot trefoil	FAC
Ludwigia palustris	water purslane	OBL
Panicum dichotomiflorum	fall panicgrass	FACW
Polygonum aviculare	prostrate knotweed	FACW-
Polygonum lapathifolium	willow smartweed	FACW
Polygonum persicaria	spotted ladysthumb	FACW
Rorippa curvisiliqua	curvepod yellowcress	OBL
Sparganium angustifolium	narrowleaf bur-reed	OBL
Trifolium repens	white clover	FAC
Typha latifolia	broadleaf cattail	OBL

Success Standard 2 and 3 – 15% Cover of Woody Species in the Scrub-Shrub Wetland
Aerial cover of woody vegetation in the scrub-shrub wetland areas was qualitatively estimated to be seven percent. This estimate does not meet the third-year cover requirement. The development of these species has been slow and little growth has been observed during site visits throughout the monitoring period.

Populus balsamifera (black cottonwood) and *Cornus sericea* (redosier dogwood) are starting to colonize the emergent wetland area. The recently planted *Spiraea douglasii* (rose spirea) in Wetland 1 are also well established. Dead *S. douglasii* were not observed and cover appears to be increasing.

Success Standard 4 – Wetland Hydrology for 12% of the Growing Season
Inundation in both ponds was observed in early and mid-May (maximum depth of 2.5 dm). Inundation and saturation was still present in mid-June. These observations suggest the wetland areas were saturated to the surface consecutively for 12% of the growing season, achieving the hydrology requirement.

Success Standard 5 – At Least Five Logs and/or Root Wads on Site
Eleven logs, root wads, and brush piles were counted on the mitigation site in 2003. Blackbirds, swallows, sparrows, and finches were observed using these structures as perching and foraging platforms during site visits.

Success Standard 6 – Use of the Site by Raptors, Passerines, and Waterfowl
A diverse list of birds has been compiled from data collected on this site throughout the monitoring period. A list of the types and species of birds contained in bird data records for this site can be found in Appendix C. Raptors, passerines, and waterfowl, have been observed on site satisfying Success Standard 6. In addition, waders and shorebirds have also been recorded. Spotted Sandpipers successfully nested on the site in 2003. Recent site visits also confirm that all of the numerous nest boxes on site are occupied, with Tree Swallows being the most prevalent nesting species.

Contingency 1 and 2 – Noxious Weeds
Aerial cover of invasive species in the wetland and upland areas of the site was qualitatively estimated to be seven percent. Four out of the six invasive species observed on the site are considered noxious weeds in Washington State (Table 3.5). As required by Contingency 1, weed control should be implemented to eliminate or reduce the presence of these species. *Phalaris arundinacea* (reed canarygrass) was identified near the southwestern end of Wetland 1 at very low cover levels, but should still be targeted in general weed control efforts.

Table 3.5 Invasive Species Present on the SR 504 Kid Valley Mitigation Site in 2003

Scientific Name	Common Name	Nativity	State Noxious Status
Cirsium arvense	Canada thistle	NonNative	Class C
Cirsium vulgare	bull thistle	NonNative	Class C
Cytisus scpoarius	Scot's broom	NonNative	Class B
Phalaris arundinacea	reed canarygrass	NonNative/Native	Class C
Rubus armeniacus	Himalayan blackberry	NonNative	Not listed
Rubus laciniatus	cutleaf blackberry	NonNative	Not listed

Lewis County Site

SR 12 Peters Road

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Assessment and Monitoring Program at the SR 12 Peters Road mitigation site in August 2003. Monitoring data were obtained to compare to fifth-year success standards. Activities include surveys of the woody and invasive plant communities. Table 4.1 provides general site information and Table 4.2 summarizes this year's monitoring results.

Table 4.1 General Information for the SR 12 Peters Road Mitigation Site

Project Name	SR 12 Peters Road Vicinity Slide Repair
Mitigation Location	SR 131 to the Cowlitz R. 1 mile south of Randle, Lewis County
Township/Range/Section (impact)	T.12N, R7E, S.7, SW/4
Monitoring Period	1999 to 2008
Year of Monitoring	5 of 10
Area of Project Impact	2.61 acres
Type of Mitigation	Non-Wetland Floodplain Forest
Area of Mitigation	5.30 acres

Table 4.2 Monitoring Summary for the SR 12 Peters Road Mitigation Site

Success Standards	2003 Results[13]
1. 40% woody cover in floodplain forest	< 5% aerial cover
2. < 10% invasive species	17% ($CI_{80\%}$ = 15–20% cover)
3. $\leq$ 40% woody cover in bank stabilization area	2-3% aerial cover

Success Standards and Sampling Objectives

Fifth-year success standards for the SR 12 Peters Road mitigation site were excerpted from the *SR 12 Peters* Road *Vicinity Slide Repair Mitigation Plan* (Null et al.1998). Sampling objectives follow success standards as appropriate. Appendix D provides the complete text of the success standards for this project.

Success Standard 1
In the fifth year following construction, the site (all communities) will have at least 40% aerial vegetative cover from woody plants alone (2003).

[13] Estimated values are presented with their corresponding statistical confidence interval. For example, 17% ($CI_{80\%}$ = 15-20% cover) means we are 80% confident that the true aerial cover value is between 15% and 20 percent.

Sampling Objective 1
To be 80% confident the true density of woody species in the entire site is within 20% of the estimated value.

Success Standard 2
In the fifth year following construction, the bank stabilization area will have at least 40% aerial vegetative cover from woody plants alone. Signs of erosion will be few to minimal or none (2003).

Success Standard 3
Assess aerial cover of noxious or invasive non-native species throughout the site. Cover should not exceed 15% in years 1-9 (2003). Particular attention to:

Cirsium vulgare (bull thistle)
Cirsium arvense (Canada thistle)
Xanthium strumarium (rough cocklebur)
Rubus armeniacus (Himalayan blackberry)

Sampling Objective 3
To be 80% confident the true cover of invasive species in the entire site is within 20% of the estimated value.

Methods

To address cover of woody species (Success Standard 1 and 2), a qualitative estimate was made during the vegetation monitoring.

A baseline was placed along the south fenceline to facilitate data collection on woody and herbaceous plant communities. Forty-four temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 4.1). Sixty-seven 50-meter point-line sample units (100 points each) were randomly positioned along the sampling transects in the planted areas to assess invasive species cover (Success Standard 3).

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objectives and the desired level of statistical confidence.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[14]
n = unadjusted sample size

For additional details on the methods described above, see the Methods section of this report.

[14] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

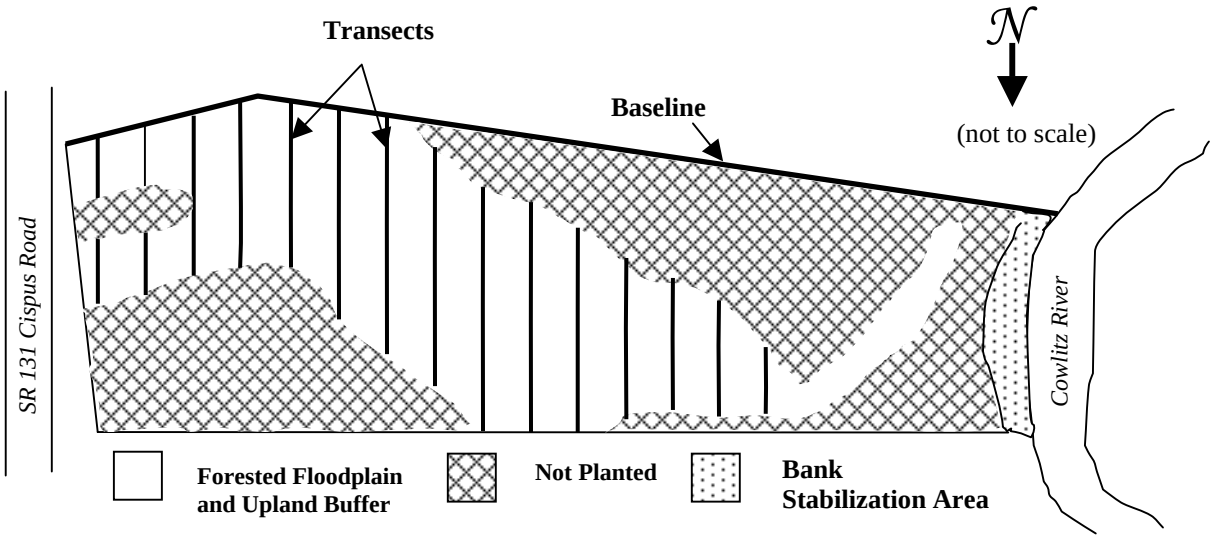


Figure 4.1 SR 12 Peters Road Mitigation Site Sampling Design (2003)

Results and Discussion

Figure 4.2 SR 12 Peters Road (August 2003)

Success Standard 1 – 40% Woody Cover in Floodplain Forest

A qualitative estimate of aerial cover provided by woody species was less than five percent (Figure 4.2). As woody species start to mature, the cover in this zone should increase. The tenth-year requirement of 75% aerial cover is not likely to be achieved without additional planting.

Success Standard 2 – At Least 40% Cover of Woody Plants in the Bank Stabilization Area

This standard was predicated on the area not being destroyed by a major flood event. However, during the winter of 2002/2003, a large portion of the on-site cut-bank slumped into the river (Figure 4.3), indicating that erosion is an active process in this location. The bank stabilization area had an estimated two to three percent aerial cover by woody species, and dense cover by herbaceous species. Large portions of the downstream adjacent riverbank are similarly sparsely vegetated. It may be that this type of event is relatively common, and the current cover by vegetation is appropriate for this part of the site.

Figure 4.3 SR 12 Peters Road Bank Stabilization Area (August 2003)

Success Standard 3 – Less Than 15% Aerial Cover of Invasive Non-Native Species
Aerial cover by invasive species was estimated to be 17% ($CI_{80\%}$ = 15-20% cover). Weed control will be necessary to meet future year requirements. Biological control specific to thistles is planned for the spring of 2004. Table 4.3 lists species of concern observed on the site.

Table 4.3 SR 12 Peters Road Mitigation Site Species of Concern (2003)

Scientific Name	Common Name	Nativity	State Noxious Status
Cirsium arvense	Canada thistle	NonNative	Class C
Cirsium vulgare	bull thistle	NonNative	Class C
Convolvulus arvensis	field bindweed	NonNative	Class C
Daucus carota	Queen Anne's lace	NonNative	Class B
Hypericum perforatum	common St. Johnswort	NonNative	Class C
Leucanthemum vulgare	oxeye daisy	NonNative	Class B
Phalaris arundinacea	reed canarygrass	NonNative/Native	Class C
Rubus armeniacus	Himalayan blackberry	NonNative	Not listed
Rubus laciniatus	cutleaf blackberry	NonNative	Not listed

Appendices

Appendix A

SR 5 Burnt Bridge Creek Success Standards

The following excerpt is from the Mitigation Plan for I-5, Salmon Creek to I-205 (Corlett 2002). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Standards of Success

Mitigation success standards begin immediately following contract acceptance (end of first-year plant establishment)

Performance Objective 1: Create native emergent wetland areas in excavated areas of the wetland mitigation site.

> ***Success Standard 1*: At year 1, there will be a minimum of 40% cover within the emergent zone.**
>
> *Success Standard 2*: At year 3, there will be a minimum of 60% cover within the emergent zone.
>
> *Success Standard 3*: At year 5, there will be a minimum of 75% cover within the emergent zone.

Performance Objective 2: Native wetland shrubs will dominate the scrub-shrub zone of the wetland mitigation site.

> ***Success Standard 1*: At year 1, there will be a minimum of 80% survival of planted species within the scrub-shrub zone.**
>
> *Success Standard 2*: At year 3, there will be a minimum of 40% cover of native wetland shrub species within the scrub-shrub zone.
>
> *Success Standard 3*: At year 5, there will be a minimum of 60% cover of native wetland shrub species within the scrub-shrub zone.

Performance Objective 3: Native riparian trees and understory shrubs will dominate the riparian zone of the wetland mitigation site.

> ***Success Standard 1*: At year 1, there will be a minimum of 80% survival of planted tree and shrub species within the riparian zone.**
>
> *Success Standard 2*: At year 3, there will be a minimum of 80% survival of native riparian tree and shrub species within the riparian zone.

Success Standard 3: At year 5, there will be a minimum of 40% cover of native riparian tree and shrub species within the riparian zone.

Performance Objective 4: Native conifer and deciduous tree species and associated understory shrubs will dominate the forested buffer zone of the wetland mitigation site.

***Success Standard 1*: At years 1 and 3, there will be a minimum of 80% survival of planted tree and shrub species within the forested buffer.**

Success Standard 2: At year 5, there will be a minimum of 40% areal cover of native wetland tree and shrub species within the forested buffer.

Performance Objective 5: Control growth and spread of reed canarygrass throughout the wetland mitigation site to ensure the success of performance objective 1 through 4.

Success Standard: At years 1 and 3 and 5, reed canarygrass will be controlled in all planting zones of the wetland mitigation site.

Appendix B

SR 504 Kid Valley Success Standards

The following excerpt is from the *SR 504 Kid valley Road to Maple Flats Vicinity Detailed Wetland Mitigation Plan* (Scott 1998). The performance criteria addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals

The goal of this wetland mitigation plan is to: 1) Replace major wetland functions lost due to project impacts; 2) Establish a self-sustaining, functional native wetland system that will provide flood storage and enhance water quality, habitat diversity, food chain support, and baseflow support along the NF Toutle River corridor; and 3) Create the 0.337 hectares (0.83 acres) of wetland required as remedial action for the existing mitigation site (SR 504-Green River to Coldwater Lake project). Excavation and contour grading combined with vegetation establishment will be used to create an expanded wetland system associated with the existing mitigation area. The site is expected to change from an upland grassland community to a structurally complex emergent and scrub-shrub wetland. In general, the created wetland will provide the following functions and values: wildlife habitat, food chain support, flood and stormwater storage and attenuation, and sediment and nutrient trapping.

Objectives and Performance Standards

Objective 1:

Replace wetland functions lost due to project impacts by creating at least 0.65 hectares (1.6 acres) of emergent and scrub-shrub wetland, of which 0.337 hectares (0.83 acres) satisfies remedial requirements, to produce a varied wetland system with vegetative structure and species diversity resembling natural systems.

Standards of Success for Objective 1:

At the end of the first year following construction:

a. At least two wetland classes, emergent and scrub-shrub, are established within the newly created wetland areas.

After 3 Years

b. The emergent wetland areas will have ≥ 50% areal cover, which is composed of a minimum of three FAC, FACW or OBL species

c. There is ≥ 15% areal cover of woody vegetation within the areas designated as scrub-shrub wetland.

After 5 Years

d. A minimum of 0.65 hectares (1.6 acres) of wetland will be created by the end of the monitoring period.
e. The emergent zones will have ≥ 80% areal cover by FAC, FACW or OBL species.
f. There will be at least 30% areal cover of woody vegetation in the areas designated as scrub-shrub wetland.
g. The combined areal cover of invasive species (reed canarygrass and Scot's broom) shall not exceed 20%.

Objective 2:

The vegetation plantings in wetland creation areas will succeed and become self-sustaining.

Standards of Success for Objective 2:

a. At least 80% of the plants initially planted will survive through the first growing season after planting
b. The planted trees and shrubs will show measurable growth between annual samplings times based on plant height or width, as shown in photo documentation.

Objective 3:

The hydrology on the site is successfully achieved by holding water for sufficient duration each spring (through May) to support hydrophytic vegetation.

Standards of Success for Objective 3:

a. Success with vegetation standards given in Objectives 1 & 2 will demonstrate success in producing adequate hydrology.
b. There is evidence of ponding or saturated soils in the newly constructed part of the wetland for 12 percent of the growing season. Evidence of ponding or saturation may include any of the hydrologic indicators of such conditions identified in the U.S. Army Corps of Engineers wetland delineation manual (Environmental Laboratory 1987).

Objective 4:

The created wetland areas will provide wildlife habitat for a variety of wetland dependent and other vertebrate species. Creation of habitat will focus on increasing both habitat diversity (number of habitat types present) and habitat complexity (number and extent of canopy levels).

Standards of Success for Objective 4:

a. Success with vegetation standards given in Objectives 1 & 2 will demonstrate success in producing wildlife habitat.

b. **A minimum of five logs and/or root wads will be found on the site during Year One and will remain on the site throughout the monitoring period.** As-built plans will show the final placement of downed logs and root wads in the created wetland areas.

c. **Raptors, passerines and waterfowl will be observed using the site for roosting, nesting or foraging habitat within the five-year monitoring period**.

Monitoring

Formal monitoring will be conducted in years 1, 3, and 5 following mitigation construction and planting and the area will be monitored concurrently with the remedial action area established for the SR 504 Green River to Coldwater Lake project. The monitoring program will assess the attributes described in the Goals and Objectives section of this report and will be performed according to procedures outlined in attached protocols (Appendix E). Monitoring reports will be issued during monitoring years to the Corps of Engineers, Department of Ecology, Cowlitz County, and other resource agencies for review and comment. Successful mitigation will be measured by attainment of performance standards listed in the goals and objectives section of this document.

CONTIGENCY PLAN

Mitigation goals and objectives will be accomplished with successful native vegetation plantings and creation of 0.65 hectares (1.6 acres) of wetland and wildlife habitat. If monitoring results indicate that standards of success will not be met, a remedial action plan will be developed and implemented. In the event that percent coverage falls short of the stated performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community. This may include planting additional stock or different plant species, grading, amending soils, or any other action deemed necessary by WSDOT wetland biologists and landscape architects. Any remedial actions deemed necessary for the success of the project will be coordinated with the U.S. Army Corps of Engineers personnel prior to implementation.

The mitigation plan is designed to utilize and promote the growth of native vegetation. **Attempts will be made to limit the spread of exotic, invasive species, which will not be allowed to dominate the site. Noxious weeds will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 20% of the vegetated areas are covered with reed canary grass before that threshold is met. The monitoring period will be extended until the performance standards are successfully met**.

Appendix C

SR 504 Kid Valley Mitigation Site Bird Status

Common Name	Scientific Name	Status[15]
Herons		
Great Blue Heron	*Ardea herodias*	wetland-dependent
Green Heron	*Butorides striatus*	wetland-dependent
Vultures		
Turkey Vulture	*Cathartes aura*	wetland-independent
Waterfowl		
Wood Duck	*Aix sponsa*	wetland-dependent
Mallard	*Anas platyrhynchos*	wetland-dependent
Hooded Merganser	*Lophodytes cucullatus*	wetland-dependent
Common Merganser	*Mergus merganser*	wetland-associated
Diurnal Raptors		
Osprey	*Pandion haliaetus*	wetland-associated
Bald Eagle	*Haliaeetus leucocephalus*	wetland-associated
Sharp-shinned Hawk	*Accipiter striatus*	wetland-independent
Rails		
Virginia Rail	*Rallus limicola*	wetland-dependent
Plovers		
Killdeer	*Charadrius vociferous*	wetland-associated
Sandpipers		
Spotted Sandpiper	*Actitis macularia*	wetland-dependent
Doves		
Rock Pigeon	*Columba livia*	wetland-independent
Mourning Dove	*Zenaida macroura*	wetland-independent
Hummingbirds		
Rufous Hummingbird	*Selasphorus rufus*	wetland-independent
Kingfishers		
Belted Kingfisher	*Ceryle alcyon*	wetland-dependent
Woodpeckers		
Downy Woodpecker	*Picoides pubescens*	wetland-independent
Northern Flicker	*Colaptes auratus*	wetland-independent
Pileated Woodpecker	*Dryocopus pileatus*	wetland-independent
Tyrant Flycatchers		
Willow Flycatcher	*Empidonax traillii*	wetland-associated
Pacific-slope Flycatcher	*Empidonax difficilis*	wetland-independent
Vireos		
Warbling Vireo	*Vireo gilvus*	wetland-associated
Red-eyed Vireo	*Vireo olivaceus*	wetland-independent
Crows and Allies		
Steller's Jay	*Cyanocitta stelleri*	wetland-independent
Scrub Jay	*Aphelocoma coerulescens*	wetland-independent
American Crow	*Corvus brachyrhynchos*	wetland-independent
Common Raven	*Corvus corax*	wetland-independent

[15] Birds are assigned an upland or wetland-dependent species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

Common Name	Scientific Name	Status
Swallows		
Tree Swallow	*Tachycineta bicolor*	wetland-associated
Violet-green Swallow	*Tachycineta thalassina*	wetland-associated
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	wetland-associated
Cliff Swallow	*Hirundo pyrrhonota*	wetland-independent
Barn Swallow	*Hirundo rustica*	wetland-associated
Chickadees		
Black-capped Chickadee	*Poecile atricapillus*	wetland-associated
Nuthatches		
Red-breasted Nuthatch	*Sitta Canadensis*	wetland-independent
Wrens		
Bewick's Wren	*Thryomanes bewickii*	wetland-independent
Winter Wren	*Troglodytes troglodytes*	wetland-independent
Marsh Wren	*Cistothorus palustris*	wetland-dependent
Kinglets		
Golden-crowned Kinglet	*Regulus satrapa*	wetland-independent
Ruby-crowned Kinglet	*Regulus calendula*	wetland-independent
Thrushes		
Swainson's Thrush	*Catharus ustulatus*	wetland-independent
American Robin	*Turdus migratorius*	wetland-independent
Starlings		
European Starling	*Sturnus vulgaris*	wetland-independent
Waxwings		
Cedar Waxwing	*Bombycilla cedrorum*	wetland-independent
Wood Warblers		
Yellow Warbler	*Dendroica petechia*	wetland-associated
Black-throated Gray Warbler	*Dendroica nigrescens*	wetland-independent
Common Yellowthroat	*Geothlypis trichas*	wetland-dependent
Wilson's Warbler	*Wilsonia pusilla*	wetland-associated
Tanagers		
Western Tanager	*Piranga ludoviciana*	wetland-independent
Sparrows and Allies		
Spotted Towhee	*Pipilo maculates*	wetland-independent
Savannah Sparrow	*Passerculus sandwichensis*	wetland-independent
Fox Sparrow	*Passeralla iliaca*	wetland-independent
Song Sparrow	*Melospiza melodia*	wetland-independent
White-crowned Sparrow	*Zonotrichia leucophrys*	wetland-independent
Dark-eyed Junco	*Junco hyemalis*	wetland-independent
Grosbeaks		
Black-headed Grosbeak	*Pheucticus melanocephalus*	wetland-independent
Evening Grosbeak	*Coccothraustes vespertinus*	wetland-independent
Blackbirds		
Red-winged Blackbird	*Agelaius phoeniceus*	wetland-dependent
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	wetland-dependent
Brown-headed Cowbird	*Molothrus ater*	wetland-independent
Finches		
Purple Finch	*Carpodacus purpureus*	wetland-independent
House Finch	*Carpodacus mexicanus*	wetland-independent
American Goldfinch	*Carduelis tristis*	wetland-independent

Appendix D

SR 12 Peters Road Success Standards

The following excerpt is from the *Peter's Road Vicinity Slide Repair Wetland Mitigation Plan* (Null et al. 1998). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals, Objectives and Standards of Success

Goals: The general goal of this wetland mitigation plan is two fold:

- Restore a non-wetland flood-plain forest similar to what existed historically, and is currently present in the northwest portion of the property. This forest will eventually more than offset the functions lost at the impacted wetland.
- Reduce stream-bank slumping by stabilizing with bioengineering techniques.

Objective #1: Riparian Forest - Restore at least 2.1 ha (5.3 ac) of pasture to a riparian forest on the Cowlitz River floodplain.

Standard of Success: Noxious Species

- **In any monitoring year except year ten, the combined aerial cover of noxious or invasive non-native species throughout the site will not exceed 15%. In year ten, this combined aerial cover will not exceed 10%. These plants include the following:**

  Cirsium vulgare (bull thistle)
  Cirsium arvense (Canada thistle)
  Xanthium strumarium (rough cocklebur)
  Rubus procerus (Himalayan blackberry)

Standards of Success: Tree and Shrub Plantings

- The first year following construction will have a minimum of 80% survival of the planted trees and shrubs with no less than 25% survivorship of each individual species.
- In the second year following construction, the site (all communities) will have at least 10% aerial vegetative cover from woody plants alone.
- **In the fifth year following construction, the site (all communities) will have at least 40% aerial vegetative cover from woody plants alone.**
- In the tenth year following construction, the site (all communities) will have at least 75% aerial vegetative cover from woody plants alone.

Objective 2: Stream-bank Stabilization - Stabilize approximately 30 linear meters (100 linear feet) of riverbank within WSDOT property of the mitigation site.

Standards of Success: Because this section of the riverbank is on a bend where erosive conditions are dynamic and at times climactic, these standards may be difficult to achieve. Those that follow are predicated on the prepared area not being destroyed by a major flood event.

- In the first year following construction, at least 50% of all as-built planted material (live stakes and/or seedlings) in the bank stabilization area will have sprouted.
- In the second year following construction, the bank stabilization area will have at least 10% aerial vegetative cover from woody plants alone.
- **In the fifth year following construction, the bank stabilization area will have at least 40% aerial vegetative cover from woody plants alone. Signs of erosion will be few to minimal or none.**
- In the tenth year following construction, the bank stabilization area will have at least 75% aerial vegetative cover from woody plants alone. Signs of erosion will be minimal to none.

Glossary of Terms

Abundance (total) – the total number of individuals, cover, frequency of occurrence, volume, or biomass of a species, or group of species, within a given area.

Accuracy – the closeness of a measured or computed value to its true value.

Adaptive management – the process of linking ecological management within a learning framework (Elzinga et al. 1998).

Aerial cover – is the percent of ground surface covered by vegetation of a particular species (or suite of species) when viewed from above (Elzinga et al. 1998). Values for aerial cover are typically obtained from point-line, point-frame, or line-intercept data.

Areal estimates – are made using the known boundary of a feature or statistical population. Areal estimates are often expressed in units of area.

Aquatic vegetation – includes submerged and rooted (*Elodea, Myriophyllum*) or floating (non-rooted) plants (*Lemna, Azolla, Wolfia*). For compliance purposes, these plants are not included in cover estimates. Vascular, rooted, floating-leaved plants *are* included in cover estimates (e.g., *Nuphar, Potamogeton*).

Bare ground – an area that can support, but does not presently support vascular vegetation.

Canopy cover – the coverage of foliage canopy (herbaceous or woody species) per unit ground area.

Community – a group of populations of species living together in a given place and time.

Confidence interval (CI) – is an estimate of precision around a sample mean. A confidence interval includes confidence level and confidence interval half-width.

Cryptogam – any of the *Cryptogamia*, an old primary division of plants comprising those without true flowers and seeds including ferns, mosses, and thallophytes (algae, fungi, and lichen).

Density – the number of plants per unit area (typically square meters).

Densitometer – a hollow T-shaped polyvinyl chloride (PVC) device that includes horizontal and vertical leveling and a mirror to locate a precise vertical point in space either directly above or directly below the densitometer. Target vegetation intersecting the vertical line of sight through the instrument is recorded.

Herbaceous – with characteristics of an herb; an annual, biennial, or perennial plant that is leaflike in color or texture, and not woody.

Hydric soils – soils formed under the conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register 1994).

Invasive – a plant that interferes with management objectives on a specific site at a specific point in time (Whitson 2001). For monitoring purposes, invasive species include those listed on the current County Noxious Weed List, and on a site-by-site basis, other species may be included (such as *Rubus armeniacus* (Himalayan blackberry)).

Line-segment – a linear sample unit that is used to measure vegetative cover.

Macroplot – usually refers to a relatively large sampling area in which sub-sampling will be conducted, often using quadrats, line-segments or point-lines (Elzinga et al. 1998).

Open water – an area intended to be non-vegetated and permanently inundated as described in the site mitigation or planting plan.

Point-frame – is a square or rectangular quadrat that consists of a set of identified points used to collect vegetation data.

Point-intercept device – a tripod that supports a rod that can be leveled and lowered vertically to intercept target vegetation at an identified point.

Point-line – linear series of points comprising a sample unit.

Point-quadrat (points) – a single point, used to sample vegetation data. The point quadrat is theoretically dimensionless.

Population (biological) – all individuals of one or more species within a specific area at a particular time.

Population (statistical) – the complete set of individual objects (sampling units) about which inferences are made.

Precision – the closeness of repeated measurements of the same value.

Quadrat – an area delimited for sampling flora or fauna; the sampling frame itself.

Random sampling – sampling units drawn randomly from the population of interest.

Relative abundance (birds) – the number of individuals per unit of sampling effort.

Relative cover – the relative cover of a plant species (or suite of species) is the proportion of the target species coverage compared to that of all species in the plant community combined (Brower et al. 1998).

Restricted random sampling method – a sampling method that divides the population of interest into equal-sized segments. In each segment, a single sampling unit is

randomly positioned. Sampling units are then analyzed as if they were part of a simple random sample (Elzinga et al. 1998).

Sample – a subset of the total possible number of sampling units in a statistical population.

Sample size equations – use sample mean and standard deviation to determine if data have been collected from enough sample units to meet the sampling objectives.

Sample standard deviation – a value indicating how similar each individual observation is to the sample mean.

Sampling – the act or process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.

Sampling objective – a clearly articulated goal for the measurement of an ecological condition or change value (Elzinga et al. 1998). Sampling objectives provide a complement to success standards and describe the desired level of precision for sampling. Elements of a sampling objective include the desired confidence level and confidence interval half-width, or the acceptable false-change error and acceptable missed-change error level.

Sampling units – the individual objects that collectively make up a statistical population.

Standard deviation – a measure of how similar each individual observation is to the overall mean value.

Shrub – a woody plant which at maturity is usually less than six meters (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

Species richness – the total number of species observed on a site.

Structures – any structure that is not expected to support vegetation during the monitoring period. Structures may include habitat structures, rocks, and other artifacts.

Stratified random sampling method – the population of interest is divided into two or more groups (strata) prior to sampling. Within each stratum the sample units are the same. Sample units from different strata may or may not be identical. Random samples are obtained within each group (Elzinga et al. 1998).

Systematic random sampling method – the regular placement of quadrats, points, or lines along a sampling transect following a random start.

Transect – For vegetation surveys, the transect is a line used to assist in the location sample units (point-lines, quadrats, line-segments or frames) across the monitoring study area.

Tree – a woody plant that at maturity is usually six meters (20 feet) or more in height and generally has a single trunk, unbranched for one meter or more above ground, and more or less definite crown (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

Vegetation structure – the physical or structural description of the plant community (e.g. the relative biomass in canopy layers), generally independent of particular species composition.

Wetland-dependent species (birds) – restricted in temporal or spatial distribution to wetlands based on an intrinsic feature or features of the environment (Finch 1989).

Literature Cited

1. Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

2. Brower, J. E., J. H. Zar and C. N. von Ende. 1998. Field and Laboratory Methods for General Ecology. WCB McGraw Hill, Boston, MA; p.88.

3. Brown, S. C. and C. R. Smith. 1998. Breeding Season Bird Use of Recently Restored Versus Natural Wetlands in New York. Journal of Wildlife Management. 62(4):1480-1491.

4. Celedonia, M. 2002. Benchmarks for Stand Development of Forested and Scrub-shrub Plant Communities at Wetland Mitigation Sites in the Lowlands of Western Washington. Washington State Department of Transportation, Olympia, WA.

5. Cooke, S. S., (ed.). 1997. A Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon. Seattle Audubon Society, Seattle, WA.

6. Corlett, D. 2002. Mitigation Plan for I-5, Salmon Creek to I-205. Washington State Department of Transportation, Southwest Region, Vancouver, WA.

7. Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of The United States. United States Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

8. Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The Birder's Handbook. Simon and Schuster, Inc., NY.

9. Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730. National Business Center, Denver, CO.

10. Executive Order 89-10. WSR 90-01-050. Protection of Wetlands. December 11, 1989.

11. Federal Register. July 13, 1994. Changes in Hydric Soils of the United States. Washington, D.C. (current Hydric Soil Definition).

12. Finch, D. M. 1989. Habitat Use and Habitat Overlap of Riparian Birds in Three Elevational Zones. Ecology 70 (4): 866-880.

13. Hruby, T., T. Granger, and E. Teachout. 1999. Methods for Assessing Wetland Functions. Volume I: Riverine and Depressional Wetlands in the Lowlands of Western Washington. Part 2: Procedures for Collecting Data. Washington State Department of Ecology Publication #99-116, Olympia, WA.

14. Kent, M. and P. Coker. 1995. Vegetation Description and Analysis: A Practical Approach. John Wiley and Sons. West Sussex, England.

15. Krebs, C. J. 1999. Ecological Methodology, 2nd edition. Benjamin/Cummings, New York, NY.

16. Kupper, L. L. and K. B. Hafner. 1989. How Appropriate are Popular Sample Size Formulas? The American Statistician (43): 101-105.

17. Null, W., S. Zaske, and D. Corlett. 1998. SR 12 Peter's Road Vicinity Slide Repair Wetland Mitigation Plan. Washington State Department of Transportation, Environmental Affairs Office, Olympia, WA.

18. Olson, D. H., Leonard, W. P., and R. B. Bury. 1997. Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific Northwest. Society for Northwestern Vertebrate Biology. Olympia, WA.

19. Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. Gen. Tech. Rep. PSW-GTR-144. Pacific Southwest Research Station, Forest Service, Department of Agriculture, Albany, CA.

20. Reed, P. B. 1988. National List of Plant Species that Occur in Wetlands: Northwest (Region 9). United States Department of the Interior. Fish and Wildlife Service. Biological Report 88 (26.9).

21. Reed, P. B. 1993. Supplement to the National List of Plant Species that Occur in Wetlands: Northwest (Region 9). United States Department of the Interior. Fish and Wildlife Service. Supplement to Biological Report 88 (26.9).

22. Scott, L. and E. Winkley. 1998. SR 504 Kid Valley Road to Maple Flats Vicinity Detailed Wetland Mitigation Plan. Washington State Department of Transportation, Environmental Affairs Office, Olympia, WA.

23. Shabman, L. A. 1995. Making Watershed Restoration Happen: What Does Economics Offer? In Rehabilitating Damaged Ecosystems, J. Cairns (ed.), pp. 35-47. Lewis Publishers, Boca Raton, FL.

24. Smith, M. R., P. W. Mattocks, Jr., and K. M. Cassidy. 1997. Breeding Birds of Washington State. Volume 4 in Washington State Gap Analysis – Final Report (K. M. Cassidy, C. E. Grue, M. R. Smith, and K. M. Dvornich, (eds.)). Seattle Audubon Society Publications in Zoology No. 1, Seattle, WA.

25. Thom, R. M. and K. F. Wellman. 1996. Planning Ecosystem Restoration Monitoring Programs. Evaluation of Environmental Investments Research Program, United States Army Corps of Engineers, IWR Report 96-R-23.

26. Thomas, J. W. (tech. Ed.). 1979. Wildlife Habits in Managed Forests – the Blue Mountains of Oregon and Washington. United States Department of Agriculture Forest Service, Agricultural Handbook No. 553.

27. United States Department of Agriculture, Natural Resources Conservation Service. 2003. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490, USA.

28. Washington State Department of Ecology. 1997. Washington State Wetlands Identification and Delineation Manual. Ecology Publication No. 96-94.

29. Washington State Noxious Weed Control Board. 2003. Washington State Noxious Weed List. www.nwcb.wa.gov. WA.

30. Whitson, T. D. (ed.). 2001. Weeds of the West. The Western Society of Weed Science. 9th edition. Grand Teton Lithography, Jackson WY.

31. Williams, M. S. 2001. New Approach to Areal Sampling in Ecological Surveys. Forest Ecology and Management 154:11-22.

32. Zar, J. H. 1999. Biostatistical Analysis, 4th edition. Prentice-Hall, Inc., Upper Saddle River, NJ.